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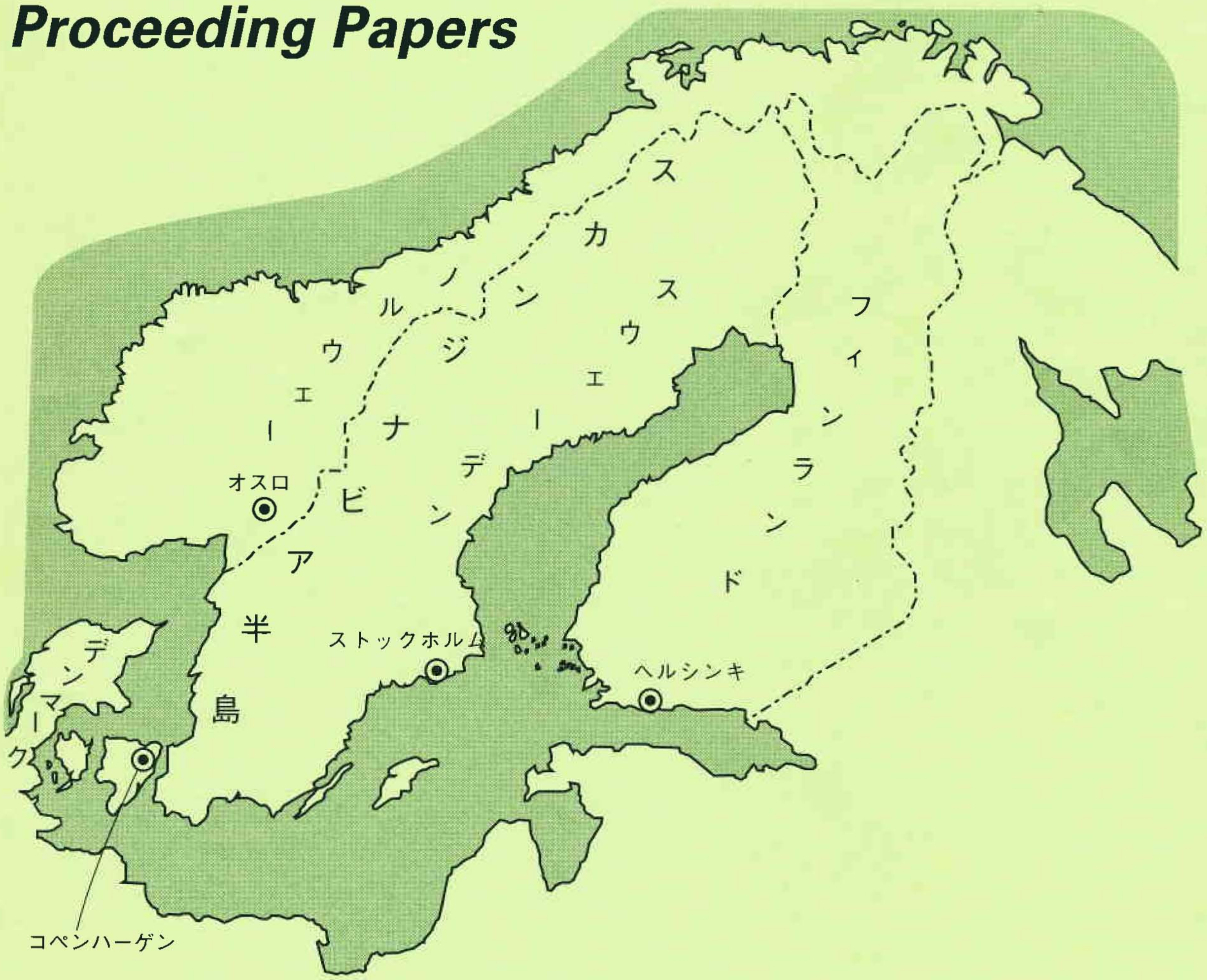
Proceeding Papers



Progress in Radiology 2012

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42: A Preliminary Report on EGFR-targeted PEGylated PLGA Immunonanobubbles as an Intratumor-specific targeted Ultrasound Contrast Agent

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17:04-17:36 **PACS**
Moderators: Norio Nakata and Hannu J Aronen

43: Patient Identifier Cross Reference Server Manages EPR and PACS Sharing system

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44: PACS and teleradiology in Finland – towards an integrated part of eHealth environment

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45: Recent advances in mobile WiFi radiology to nursing homes and prisons

Frode Lærum, MD PhD
Akershus University Hospital, Norway

46: Intuitive User Interface for 3D Image Manipulation using Augmented Reality and a Smartphone

Norio Nakata, MD, Yukio Miyamoto, MD, Kunihiko Fukuda, MD
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[Purpose]

We introduced cloud computing technology, the server based computing (SBC) system as an infrastructure of the total integrated PACS and EPR of Tottori Univerisity Hospital on 2008. SBC has many advantages for hospital system on security and cost-effectiveness. We also started to use SBC as an infrastructure of a regional cross reference system between two hospital from July 2010. But in this system we must register the other hospital staffs on own EPR system, who are related to the shared patients. In this way it should be complicated if the related hospitals increase.

On this paper we would report the development of EPR and PACS sharing system with the Patient Identifier Cross Reference Server.

[Methods]

We made the users and patient identifier cross reference management server, which stored identifiers and passwords of the registered users in the six hospitals. The shared patients had the identifier for each hospital. The server stored the list of identifiers for each patient. This server is also the portal of this sharing system. This server manages SBC servers for the hospital EPRs and PACSs. SBC servers had client applications and were connected to hospital EPR and PACS servers via VPN. Hospitals had the access terminals, which were installed SBC client application.

[Results]

In this system development we should modify four EPRs of three venders and four PACSs of three venders to access the patient record with common ID and password and patient ID automatically and not to access to the other patient records.

This sharing system could use EPR, PACS and subsystems of each hospitals. It did not demand other data storage except original storage in the hospital. So we thought the maintenance fee could be kept low. The whole regional storage also should not be increased. Every access logs were stored in this system and each hospital systems. So it should be secure. We could access all the record included even subsystem, and the old data and future.

44: PACS and teleradiology in Finland – towards an integrated part of eHealth environment

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Introduction

First experiments of teleradiology have been made in Finland in 1960-ties, but clinical teleradiology started in 1990-ties. Two surveys made in the middle of that decennium revealed that most of the hospital districts had at least some teleradiology activity. Before the turn of millennium PACS became a more important activity and all the hospital districts were digitized by 2007. Next challenge is to integrate medical imaging into comprehensive electronic medical record and eHealth environment. At the same time usability issues have become more and more important.

During the first decade of 2000-ties, the Finnish government invested substantially in health care IT technology and regional eHealth environments were being built with an integrated electronic patient record (EPR) as the core application.

Materials and methods

FinnTelemedicum at the University of Oulu together with National Institute of Health and Welfare has performed a comprehensive survey of all public health care institutions (all 21 hospital districts and 140 primary health centres) and most prominent private service providers in 2003, 2005, 2007 and 2010. The surveys are web-based and targeted to top officials at medical and informatics departments. The results are analysed at SPSS statistics with descriptive frequencies of availability and intensity of usage. The results have been compared to previous years in order to build a timeline of progress.

In 2010 a parallel usability survey was targeted to Finnish physicians. The main target was to measure how electronic medical records and connected systems performed in real professional use. Altogether nearly 4000 physicians answered the web based survey and in further analysis this sample showed that it was descriptive and valid compared to the Finnish physician population. This wide survey was performed by Finnish Medical Association, FinnTelemedicum at the University of Oulu, National Institute of Health and Welfare and Aalto University.

Results

The results show that more than 94% of primary health care centres were using electronic patient record as a primary source of patient information already in 2003. For hospitals, the same level was reached in 2005. Full 100% coverage in all public health institutions was reached in 2007. Filmless PACS environment was in production in 12 out of 21 hospital districts in 2003 and by the end of 2007 all the hospital districts were filmless. During the latest year 2010 survey the use of teleradiology has increased. In the Finnish environment, EPR is tightly integrated with PACS, laboratory systems and electronic referral system. Existing situation in Finland favors regional PACS environments where each archive mainly serves one hospital district area, including both secondary and primary care. If the patient has not cancelled his/her permission, images are available to all professionals taking part of patient care within a hospital region.

According to the EPR usability study, all the electronic patient record programs need improvement.

Local usage is in many cases too time-consuming. There are problems in information exchange between different institutions, especially when patient narratives or medication lists are needed. On the other hand, medical images, radiology reports and laboratory results are readily available.

Discussion

The present challenge in Finland in to build one lifelong national archive for digital medical data called an eArchive. There is a law from year 2007 which states that every public health care institute must join in. According to an amendment from year 2010 institutions should first join ePrescription service between 2013 and 2014. The integration to the national long term archive will take place gradually between 2014 and 2015. Patient narratives and core medical data are the target of the initial phase. Only the radiology reports will be included into the first phase, while long term storage for images is scheduled to be solved in next phase starting from year 2016. Imaging data can be exchanged between institutions using DICOM tools because of unique nationwide patient ID even when waiting for the national solution.

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45: Recent advances in mobile WiFi radiology to nursing homes and prisons

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Nursing homes are the biggest institutional sector in Norway, with more than three times as many beds compared to all somatic hospitals. Referrals to radiologic examinations are the most common following acute/sub acute health events from nursing homes to the specialist health care system. From Akershus University Hospital we serve 28 nursing homes and elderly psychiatric facilities, as well a one prison.

During the first eight-months period, 271 patients were examined and 297 radiographs taken. A prototype mobile, digital radiographic system (ATX QUANT power 400, Atomed X-ray GmbH Germany) integrated Canon CXDI-55C detector was transported in a small van with wheelchair ramp. The examinations are performed in the patients' rooms. The digital images are imported to our hospitals Picture Archiving and Communication System (PACS) by WiFi secure internet connection directly from the equipment at distant location, or via an USB memory stick.
The images are reported same day, usually after 3-4 hours. In the case of x-ray pathology, the referring physician was informed by phone.
Minor trauma and respiratory symptoms were the most common referral reasons. Out of 297 x-rays we found 66 with pathology (22%). Ten patients needed hospitalisation (3,7%). The others were treated locally. If including those with negative x-ray studies, 95% of the – often dement - patients avoided cumbersome, exhaustive transportation to hospital. In the prison population, 5 positive x-rays out of 40 cases (13%) were encountered, all managed locally.
The qualities of the x-rays were satisfactory.

In Norway, we have now experience with 7000 x-ray exams from 3 operating mobile radiology units at various locations, with more units planned.
A variety of support systems, like pocket-size bucky, carbon patient support plates or support pillows are in prototypes or under construction in collaboration with designers. New, dedicated digital/wire-less x-ray systems are in progress.

Mobile X-ray is an improved service design to elderly, weak or vulnerable patients, which are difficult or hazardous to move from their permanent residence. Expensive, unnecessary and unpleasant patient transportations or hospitalisations are avoided.

46: Intuitive User Interface for 3D Image Manipulation using Augmented Reality and a Smartphone

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Although widely used as a pointing device (PD) on personal computers (PCs), the mouse was originally designed for control of two-dimensional (2D) cursor movement and is not suited to complex three-dimensional (3D) image manipulation. One of next-generation user interface (UI) technologies is augmented reality (AR), a type of 3D virtual reality that aims to duplicate the real-world environment on a computer. AR is a field of computer science that involves combining the physical world and an interactive 3D virtual world. Optical tracking with fiducial markers is commonly used in AR systems. AR computer systems use video tracking capabilities to calculate the real camera position and orientation relative to the optical marker in real time. Once the real camera position is known, a virtual camera can be positioned at the same point and 3D objects drawn exactly overlaid on the real fiducial marker on the computer screen. AR represents a new 3D user interface paradigm.
The multi-touch input method represents another new UI. The widespread adoption of smartphones and tablet computers is changing the personal computing experience. This study was performed as a pilot assessment of an intuitive PD for 3D/4D image manipulation using AR integrated with the touchscreen UI of the smartphone. The iPhone is placed in a hard case (jacket) with a 2D printed fiducial marker for AR on the back. Using this marker and a conventional PC with an embedded web camera, the radiologist can easily manipulate the 3D/4D images obtained by CT and MRI in an AR environment. The iPhone is connected to the PC over wireless LAN, and the iPhone with a touch screen UI is used as a remote controller of 4D video images. The AR UI has a number of advantages for such applications, including interactivity and virtual actions. In conclusion, our pilot assessment of a novel 3D image manipulation UI using AR technology and a smartphone as a remote control suggest the future improved usability of 3D workstations.